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(54) Shaped article made of carrier fibres and thermoplastic binder fibres, and method of manufacturing it.

(57) A shaped article made of a mixture comprising a major content of carrier fibers that are not capable of being shaped by pressure or heat, and a minor content of binding fibers of a thermoplastic synthetic material, wherein the shaped article is made of a mixture comprising the carrier fibers in the form of an incoherent nodulated fiber material or fiber bundles having a diameter of 2-10 mm, and the binding fibers having a length of 5-25 mm and a diameter of 10-30 microns, the bulk density of the shaped article being 0.08-30 g/cm³.

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A shaped article made of a mixture comprising a major content of carrier fibers and a minor content of binding fibers of a thermoplastic synthetic material, and a method of manufacturing the shaped article

This invention relates to a shaped article made of a mixture comprising a major content of carrier fibers that are not capable of being shaped by pressure or heat and a minor content of binding fibers of a thermoplastic synthetic material.

A felt material of mineral fibers have long since been used as a carrier or matrix for growing plants. The starting material is then a mineral fiberboard bound by impregnation with a phenol formaldehyde resin, which fiberboard is of the type actually known for heat insulating purposes. Blocks or cylinders having a height of, e.g., 30 mm and a diameter of, e.g., 18 mm or a cross-section of 18×18 mm are cut from the mineral fiberboard. One end of the cylinders is provided with a hole in which a grain of seed is placed. A plurality of thus prepared cylinders is then placed on, e.g., a carrying frame or a tray of, e.g., polystyrene and kept moist. This permits the seed to germinate, and the root hairs of the embryo penetrate into the porous cylinder made of the mineral fiber material. After the root system has sufficiently developed, the cylinder along with the sprout developed therein is transplanted to a larger block or cube likewise made of a mineral fiberboard bound with a resin, in which cube a hole is provided which is large enough to receive the whole of the cylinder penetrated by roots. If required, the cylinder along with the sprout developed therein may be transplanted to peat earth.

In case of transplantation it is important that a superior hold and support should be permanently given to the root system.

The manufacture of the germinating cylinders or blocks from the mineral fiberboard has the drawback of being cumbersome and causing much waste. Moreover, the use of phenol formaldehyde resin as binder may be detrimental to the plant.

The object of the invention is to provide a shaped article, such as cylinders and blocks, of the type specified in the opening paragraph, which is suitable in itself as a carrier or matrix for containing and germinating therein a grain of seed and for further growing the embryo for some time or transplating the grown sprout, said shaped article being appropriate for immediate manufacture in the desired form enabling the selection from a plurality of binders, as well as a method of making the shaped article.

According to the invention there is provided a shaped article characterized in that the shaped article is made of a mixture comprising the carrier fibers in the form of an incoherent nodulated fiber material or fiber bundles having a diameter of 2-10 mm, and the binding fibers having a length of 5-25 mm and a diameter of 10-30 microns, the bulk density of the shaped article being 0.08-0.30 g/cm^3.

The carrier fibers available in the shaped article according to the invention in a major content may be selected from natural organic fibers, e.g., coco fibers, sisal fibers or peat, or from mineral fiber material, e.g., rock wool.

As the binding fibers are used according to the invention in the form of solid particles, namely in the form of short fibers of a thermoplastic synthetic material, and not in liquid form, a shaping treatment is rendered possible to obtain a shaped article with no special drying being required afterwards. Providing the binding fibers as short fibers is conducive to the formation of a porous spatial network structure with retention of strength and cohesion.

With a view to using the shaped article as a carrier or matrix for germinating grains of seed and growing plants therein, a thermoplastic synthetic material will be selected for manufacturing the solid binder, although the invention is not restricted thereto, said thermoplastic synthetic material being absolutely harmless from environmental considerations, in particular from the viewpoint of food chemistry. In addition to the fact that the fibrous solid binder of the selected thermoplastics synthetic material must give sufficient mechanical strength and porosity to the shaped articles obtained therewith, the material should also be entirely resistant to the effect of the food with which the vegetable material is grown, at least for the period until the root system has developed completely and the sprout has been transplanted along with the matrix.

As far as the selection of the thermoplastic synthetic material from which the fibrous binder has been manufactured is concerned, a material will be preferred with which a smooth, uncomplicated shaping treatment is possible, that is to say the bonding process proceeds rapidly, and the shaped article has sufficient mechanical strength immediately after its being formed so as to be handled without damage. In this connection a thermoplastic synthetic material is advantageously selected which combines a low glass transition temperature of 30-180°C, preferably lower than about 70°C, with good bonding properties.

The desired properties as enumerated above are completely met by fibers made of a copolymer comprising 80-90% vinyl chloride and 10-20% vinyl acetate. Such fibers are physiologically harm-

less and are resistant to water and many acids, bases and solvents. The melting behaviour is then such that with a continuously decreasing viscosity the fibers begin to stick above the glass transition temperature and are deformed more and more easily until the fiber structure completely disappears above the melting point.

The invention also relates to a method of manufacturing a shaped article according to the invention, which comprises preparing a mixture having a major content of carrier fibers that are not capable of being formed by means of pressure or heat and a minor content of binding fibers of a thermoplastic synthetic material, and then subjecting the mixture in dry form to a shaping treatment using heat and/or pressure, and which process is characterized in that an incoherent mixture having a bulk density of 0.05-0.15 g/cm^3 is prepared from loose agglomerates of the carrier fibers said agglomerates having a diameter of 2-10 mm, and the incoherent binding fibers made of a thermoplastic synthetic material having a fiber length of 5-25 mm and a diameter of 10-30 microns, which mixture is then subjected to a shaping treatment by casting the dry mixture into a mould, vibrating it and heating it, to a temperature above the glass transition temperature of the thermoplastic synthetic material, and using a light pressure that does not lead to a bulk density of the shaped article of more than 0.08-0.30 g/cm^3, after which the mixture is cooled to a temperature below the glass transition temperature and the shaped article is removed from the mould.

As regards the solid binder of the thermoplastic synthetic material, fibers are used having a length of 5-25 mm and a diameter of 10-30 microns.

An optimum mixing is obtained if the two fiber components are processed to an aqueous suspension having a solid content of about 2-10%. Of course, for further processing the same the mixture recovered from the suspension should first be subjected to a drying process. This additional treatment means a complication which may be prohibitive from an economical viewpoint.

In the manufacutre of the shaped articles according to the invention good results are also obtained if the two fiber components are mixed in dry condition in a slowly rotating mixer, e.g., in a concrete mixer.

It is possible within the framework of dry mixing of the fiber components first to wet the binding fibers made of the thermoplastic synthetic material with water in an amount of 10-15%. If it is wished to affect the hydrophilic character of the ready shaped article, a wetting agent to be used for this purpose may be added during this wetting stage.

In the case of dry mixing mineral wool is used as the carrier fiber material provided in the mixture in major content, said carrier fiber material being in the form of wool particules nodulated to obtain a proper mixing with thermoplastic binder fibers. Such nodulated mineral wool particles are commercially sold, e.g., in the form of rock wool grains. The diameter chosen for the mineral wool particles is preferably 2-10 mm. The thermoplastic fibers then serve as binder between such nodulated wool particles. A content of thermoplastic fibers of 2-20 wt.% is then sufficient to form an adequately strong spatial network, the nodulated wool particles being surrounded by the thermoplastic fibers which are interconnected. The spatial skeletal structure as a result of the interconnected thermoplastic fibers and the fact that nodulated wool particles are bonded by means of fibrous thermoplastic material prove to give the final shaped article its strength.

If the starting materials are nodulated mineral wool as carrier fibers and binding fibers made of the copolymer vinyl chloride/vinyl acetate as the solid binder, the mixture prepared from these fiber components can be further processed by heating it with, e.g., hot air, or also by high-frequency heating, and bringing it to a temperature above about 80-100°C, said temperature being above the glass transition temperature of the copolymer, but clearly below its melting point, namely 160°C. At this temperature the binding fibers develop a proper stickiness without losing the fiber structure. A proper bond between the components of the mixture is already obtained by keeping the polymer fibers at said temperature of 80-100°C for a short time for 0.5-1 min. The mixture is then brought into the contemplated form by pressing and fixing it in this form by cooling, e.g., by blowing cold air, to below the glass transition temperature. The resulting shaped article can be removed from the mould and is easy to handle for further processing.

In addition to selecting a thermoplastic synthetic material for preparing the binder fibers which shows a uniform melting behavior, such as the vinyl chloride/vinyl acetate copolymer, there may also be selected a synthetic material having a much more abrupt melting process. An example of this is polyethylene, which has the advantage of being cheap. The abrupt course of the melting process, however, impedes the ease of handling of the binder fibers. Another example is polypropylene.

The method according to the invention is easily carried out with relatively simple means. For this reason it can also be used by small consumers, e.g., in the developing countries.

Claims

1. A shaped article made of a mixture comprising a major content of carrier fibers that are not capable of being shaped by pressure or heat, and a minor content of binding fibers of a thermoplastic synthetic material, characterized in that the shaped article is made of a mixture comprising the carrier fibers in the form of an incoherent nodulated fiber material or fiber bundles having a diameter of 2-10 mm, and the binding fibers having a length of 5-25 mm and a diameter of 10-30 microns, the bulk density of the shaped article being 0.08-30 g/cm^3.

2. A shaped article according to claim 1, characterized in that the binding fibers are made of a thermoplastic synthetic material having a glass transition temperature of 30-180°C.

3. A shaped article according to claim 2, characterized in that the glass transition temperature of the thermoplastic synthetic material is less than about 70°C.

4. A shaped article according to claim 3, characterized in that the thermoplastic synthetic material is a copolymer of about 80-90% vinyl chloride and 10-20% vinyl acetate.

5. A method of manufacturing a shaped article according to claims 1-4, which comprises preparing a mixture having a major content of carrier fibers that are not capable of being formed by pressure or heat, and a minor content of binding fibers of a thermoplastic synthetic material, and then subjecting the mixture in dry form to a shaping treatment using heat and/or pressure, characterized in that an incoherent mixture having a bulk density of 0.05-0.15 g/cm^3 is prepared from loose agglomerates of the carrier fibers, said agglomerates having a diameter of 2-10 mm, and the incoherent binding fibers made of a thermoplastic synthetic material having a fiber length of 5-25 mm and a diameter of 10-30 microns, which mixture is then subjected to the shaping treatment by casting the dry mixture into a mould, vibrating it, and heating it to a temperature above the glass transition temperature of the thermoplastic synthetic material, and using a light pressure that does not lead to a bulk density of the shaped article of more than 0.08-0.30 g/cm^3, after which the mixture is cooled to a temperature below the glass transition temperature and the shaped article is removed from the mould.

6. A method according to claim 5, characterized in that the thermoplastic synthetic material has a glass transition temperature of about 70°C.

7. A method according to claim 6, characterized in that the thermoplastic synthetic material is a copolymer of 80-90% vinyl chloride and 10-20% vinyl acetate.

8. A method according to claims 5-7, characterized in that said mixture is prepared by processing the two fiber components to an aqueous suspension having a solids content of 2-10%, and that after recovery from the suspension the mixture is first dried for further processing.

9. A method according to claims 5-6, characterized in that the two fiber components are mixed in dry condition in a slowly rotating mixture, using mineral wool in nodulated form as the carrier fiber material.

10. A method according to claim 9, characterized in that prior to mixing the binding fibers of the thermoplastic synthetic material are wetted with water in an amount of 10-15 wt.%, if required in combination with a wetting agent.

11. A method according to claims 5-7, characterized in that when fibers of the vinyl chloride/vinyl acetate copolymer are used in the mixture as binding fibers, said fibers are maintained at a temperature of 80-100°C for 0.5-1 min., which mixture is then shaped in a mould by applying a light pressure and cooled, and the shaped article is removed from the mould.

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EUROPEAN SEARCH REPORT

Application number

EP 87 20 0884

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	GB-A-2 096 195 (VAN DRESSER) * Claims 1-7,15,18-24,33 *	1,5	D 04 H 1/00 D 04 H 1/54
A	US-A-2 609 539 (AMERICAN VISCOSE) * Claim 1 *	4,7	
A	US-A-2 145 899 (OWENS-CORNING) * Claim 1 *	1,5	
A	FR-A-2 445 103 (SALIGNY)		
A	DE-A-3 121 277 (ICOPAL)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D 04 H
B 29 B
D 21 H
A 01 G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24-08-1987	CATTOIRE V.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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